

CLAIMS

1. A cyclone assembly comprising a cyclone chamber, an inner cyclone liner adapted to be received within the cyclone chamber, and displacement means for  
5 displacing the inner cyclone liner relative to the cyclone chamber between an operative position and an inoperative position.
2. A cyclone assembly as claimed in claim 1 in which the cyclone chamber  
10 comprises an outer cyclone liner.
3. A cyclone assembly as claimed in claim 2 in which the inner cyclone liner is adapted to be displaced along a longitudinal axis of the outer cyclone liner between the operative position and inoperative position.  
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4. A cyclone assembly as claimed in claim 3 in which a seal is provided at a lower end of the inner cyclone liner, which seals between the inner and outer cyclone liners when the inner cyclone liner is in the operative position.  
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5. A cyclone assembly as claimed in any preceding claim in which the inner cyclone liner has an inlet let into its periphery.  
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6. A cyclone assembly as claimed in any one of claims 2 to 5 in which the outer cyclone liner has an inlet let into its periphery.
- 30 7. A cyclone assembly as claimed in any preceding claim in which the inner cyclone liner has an overflow outlet for fluids at an upper end and a discharge outlet for solids at its lower end.
8. A cyclone assembly as claimed in any one of claims 2 to 7 in which the outer  
35 cyclone liner has an overflow outlet for fluids at an upper end and a discharge outlet for solids at a lower end.

9. A cyclone assembly as claimed in claim 8 in which the inner cyclone liner is able to pass through the overflow outlet of the outer cyclone liner.

5 10. A cyclone separator including a cyclone assembly as claimed in any one of claims 1 to 9 in which the cyclone assembly is contained within a housing.

11. A cyclone separator as claimed in claim 10 in which the housing has an inflow chamber, an overflow chamber and a discharge chamber.

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12. A cyclone separator as claimed in claim 11 in which a fluid supply duct is provided in fluid communication with the inflow chamber.

13. A cyclone separator as claimed in claim 11 or claim 12 in which the cyclone  
15 chamber is substantially contained in the inflow chamber.

14. A cyclone separator as claimed in any one of claims 11 to 13 in which the inner cyclone liner can be positioned concentrically within the cyclone chamber in the operative position, or displaced axially to the inoperative position within the overflow  
20 chamber.

15. A cyclone separator as claimed in any one of claims 10 to 14 in which actuation of the displacement means is automatic, and is triggered when a predetermined pressure differential is detected between an inflow and outflow of the separator.

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16. A cyclone separator as claimed in any one of claims 10 to 15 in which the displacement means is a threaded spindle.

17. A cyclone separator as claimed in any one of claims 11 to 14 in which the  
30 displacement means is a threaded spindle and a hand wheel is provided for actuation of the threaded spindle by rotation.

18. A cyclone separator as claimed in any one of claims 10 to 16 in which the displacement means is powered either by a hydraulic or pneumatic actuator.

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19. A cyclone separator as claimed in any one of claims 10 to 16 in which the displacement means is powered by an electric actuator.
20. A cyclone separator as claimed in any one of claims 10 to 16 in which the  
5 displacement means is powered by springs.
21. A cyclone separator as claimed in claim 15 in which the displacement means is powered by the pressure differential between the inflow and outflow of the separator.
- 10 22. A cyclone separator as claimed in any one of claims 11 to 21 in which a fluidising unit is connected to the discharge chamber.
23. A cyclone separator as claimed in any one of claims 9 to 22 in which a heated jacket is provided around the separator.
- 15 24. A cyclone separator as claimed in any one of claims 9 to 22 in which the cyclone separator is adapted to be heated by heat tracing.
25. A cyclone separator as claimed in any one of claims 9 to 24 in which the cyclone  
20 separator is incorporated in a choke or a blow-out protector.
26. A cyclone separator as claimed in any one of claims 9 to 24 in which the cyclone separator is incorporated in a wellhead assembly or manifold.
- 25 27. A cyclone separator as claimed in any one of claims 9 to 24 in which the cyclone separator is adapted to be operated on the seabed.
28. A cyclone separator as claimed in claim 27 in which the cyclone separator is adapted to be operated by a remotely controlled vehicle on the seabed.
- 30 29. A cyclone separator as claimed in claim 27 or claim 28 in which the cyclone separator is positioned on the seabed and arranged to remove solids from a fluid flow prior to a process or separation system.

30. An apparatus for treating a well head stream comprising a plurality of cyclone separators as claimed in any one of claims 9 to 24 mounted on a skid, a receiving vessel for solids and a hydro-transportation device for discharging cleaned solids.
- 5 31. An apparatus for treating a well head stream as claimed in claim 30 in which the receiving vessel for solids includes a cleaning cyclone, a re-circulation inductor and de-agglomeration means.
32. An apparatus for treating a well head stream as claimed in claim 31 in which the  
10 de-agglomeration means is either chemical or ultrasonic.
33. An apparatus for treating a well head stream as claimed in any one of claims 30 to 32 in which the hydro-transportation device discharges directly into the sea or when in sub-sea operation, into a riser.
- 15 34. A method of increasing the flow capacity of a cyclone separator during use, comprising the step of withdrawing an inner cyclone liner from an operative position within a cyclone chamber to an inoperative position axially spaced from the cyclone chamber.
- 20 35. A method as claimed in claim 34 in which the pressure between an inlet and an outlet of the cyclone separator reduces as the flow capacity increases.
36. A method of reducing the flow capacity of a cyclone separator during use,  
25 comprising the step of inserting an inner cyclone liner to an operative position within an outer cyclone liner from an inoperative position axially spaced from the outer cyclone liner, thereby making the inner cyclone liner, which has a smaller internal diameter, the operative liner of the cyclone separator.
- 30 37. A method as claimed in claim 36 in which the pressure between an inlet and an outlet of the cyclone separator increases as the flow capacity reduces.